Improving HMS Reconstruction:
Alternate COSY Matrix Elements

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Hall C Workshop – January 15, 2011

δ (dp/p) correction

→ Known for 10+ years that dp/p reconstruction looks to be over-fitted.

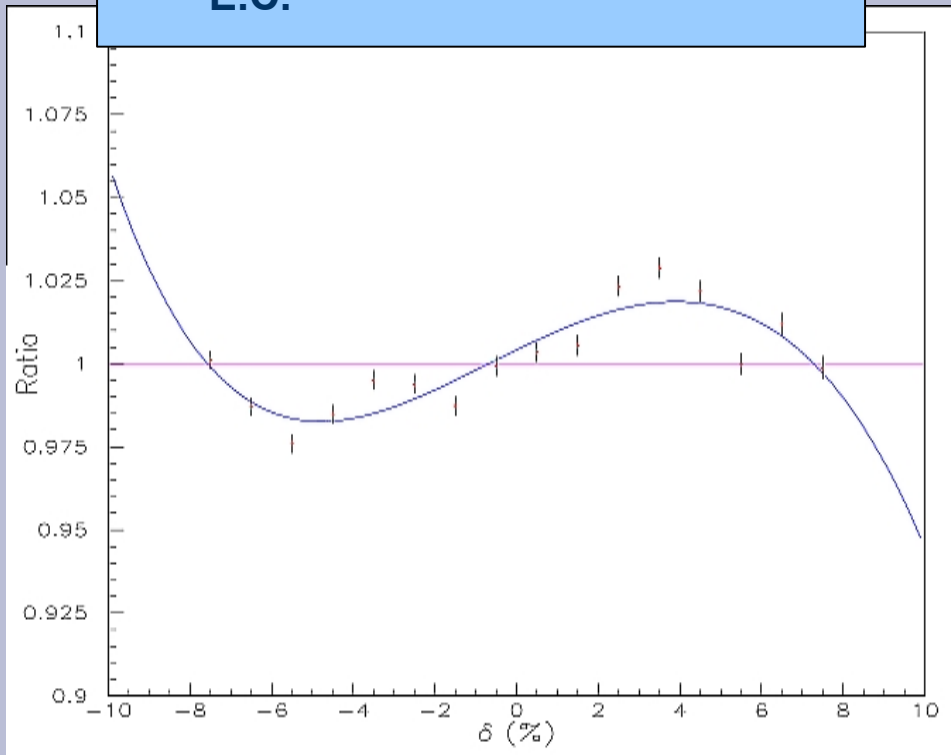
→ Study with inclusive data/MC for wide range of kinematics and targets.

→ Systematics in cross section model average out over over many targets, beam energies, and angles.

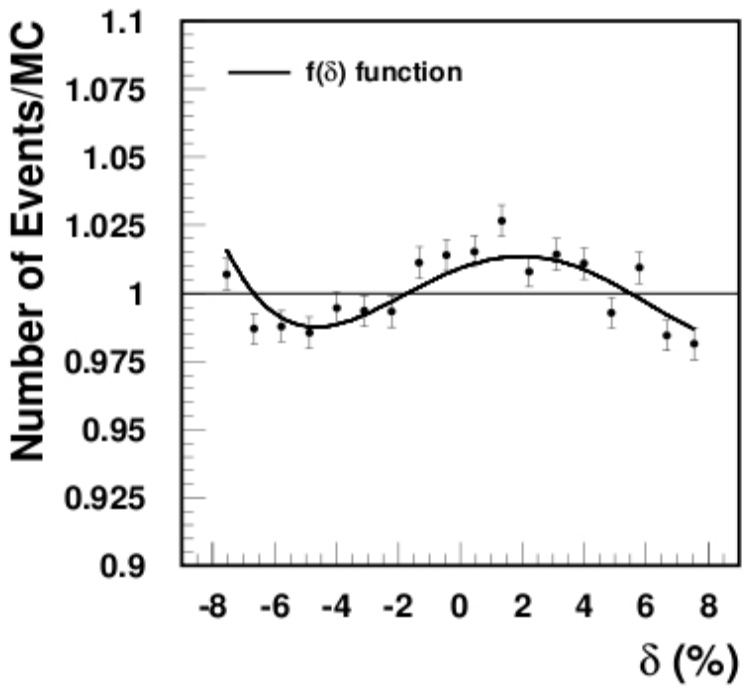
=> Remaining differences versus dp/p are due to data/MC optics or acceptance.

δ correction - 2

Fit from E94110 data (1999)
E.C.



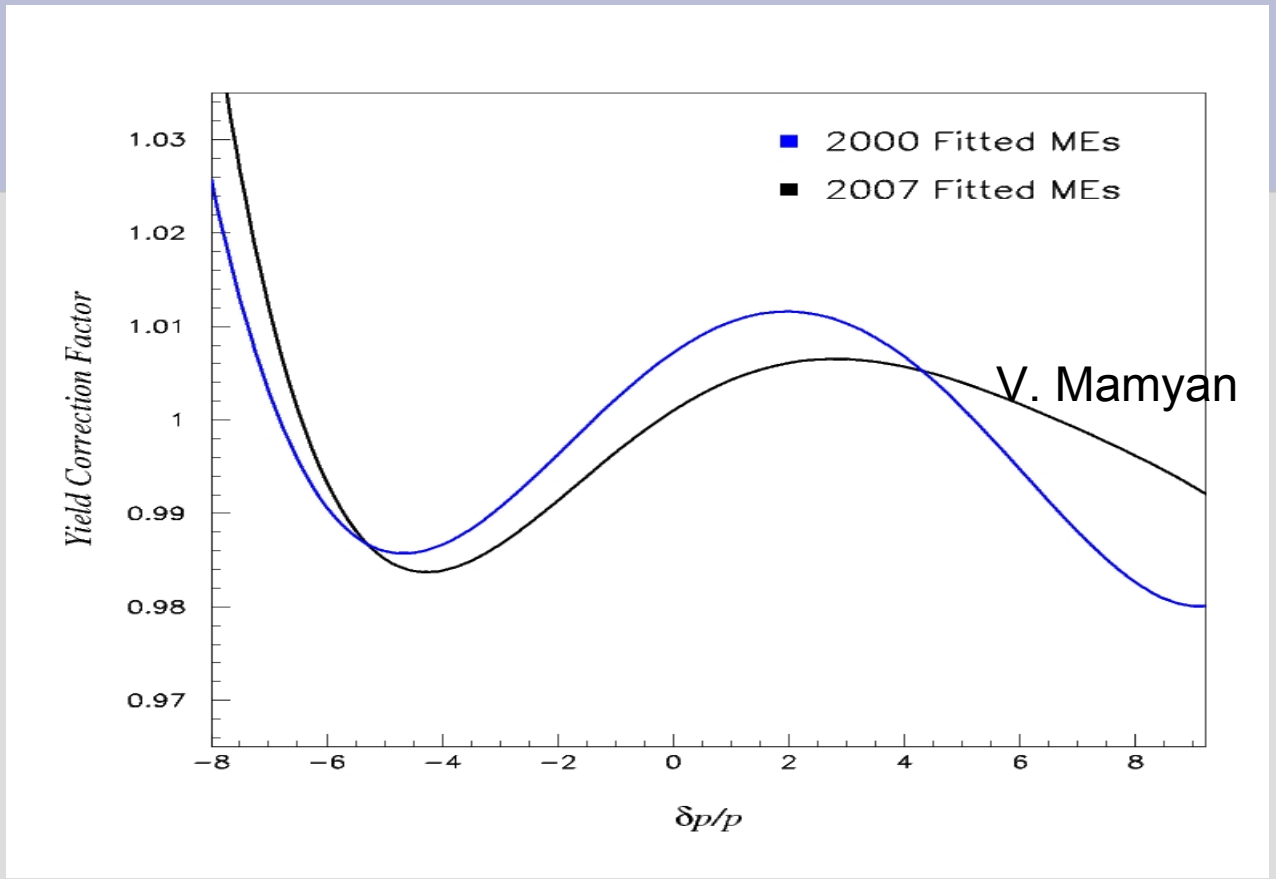
Fit from E99118 data (2000).
V. Tvaskis dissertation



→ Data from 1999-2003 showed very consistent correction factor

→ Can be explained by small (< 4x10-4) over fitting of δ reconstruction MEs.

Then and Now



→ Small shift, but general shape consistent.

→ Difference due to small 2007 DC shift (~ 0.5 mm)?

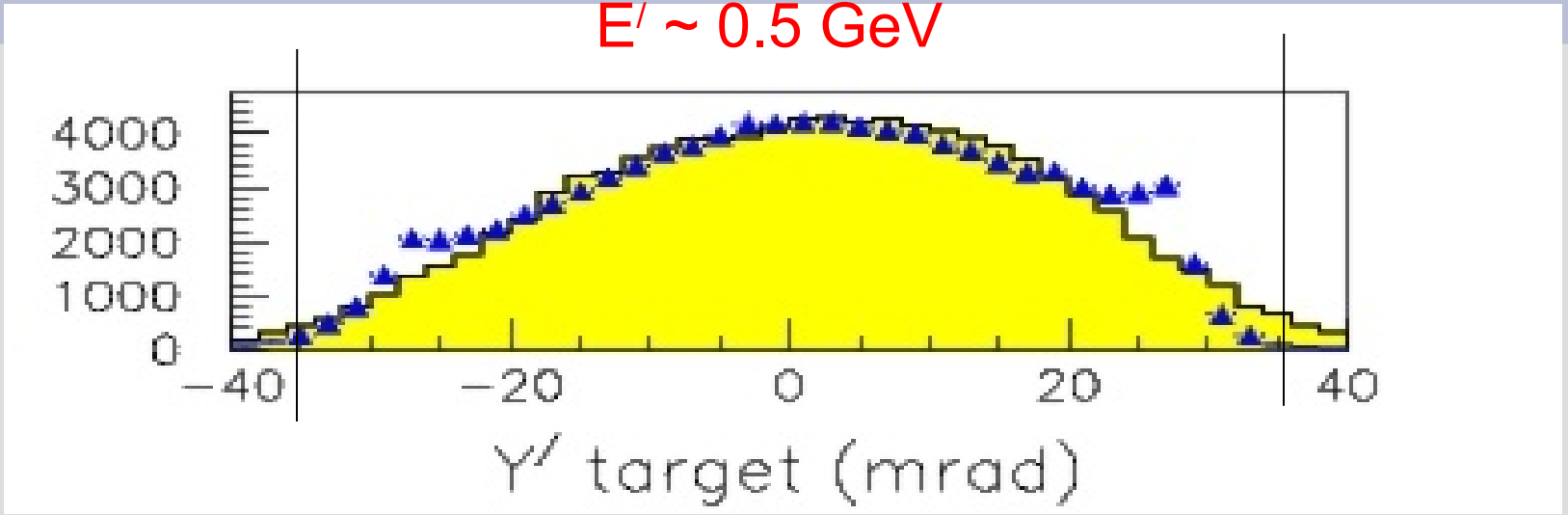
But ...

From 2003-2005 we also needed to deal with large multiple scattering at thick HMS exit window.

(20 mil Titanum at that time)

Reconstruction Problem at Low E′

(Already discussed at previous workshops)



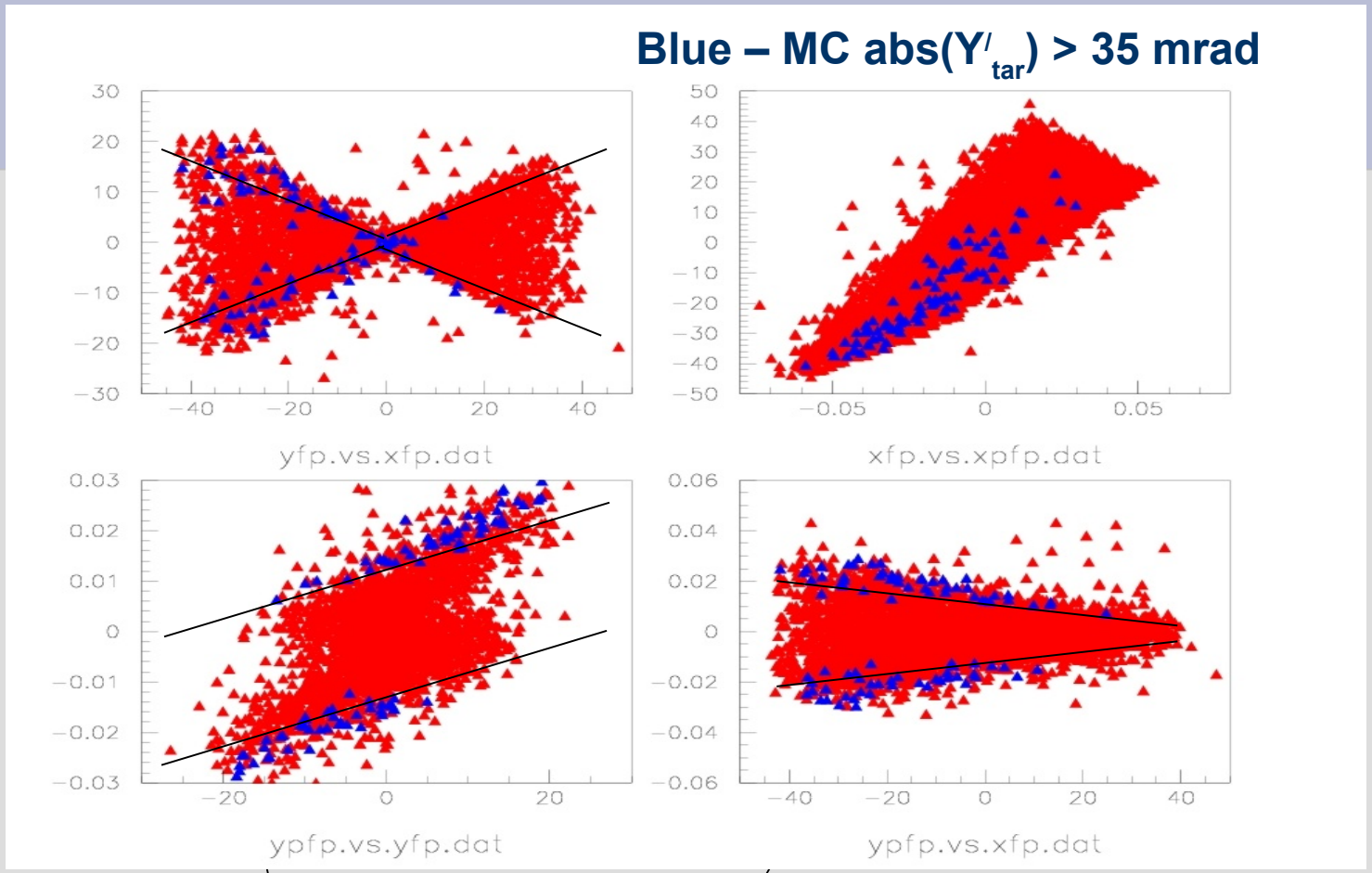
→ Large multiple scattering caused by thick HMS exit window (20 mil Titanium).

→ Events in tails are reconstructed at Y' ~ +/- 28 mrad for ***Data.***

Fitted reconstruction matrix elements have anomalous behavior for tails.

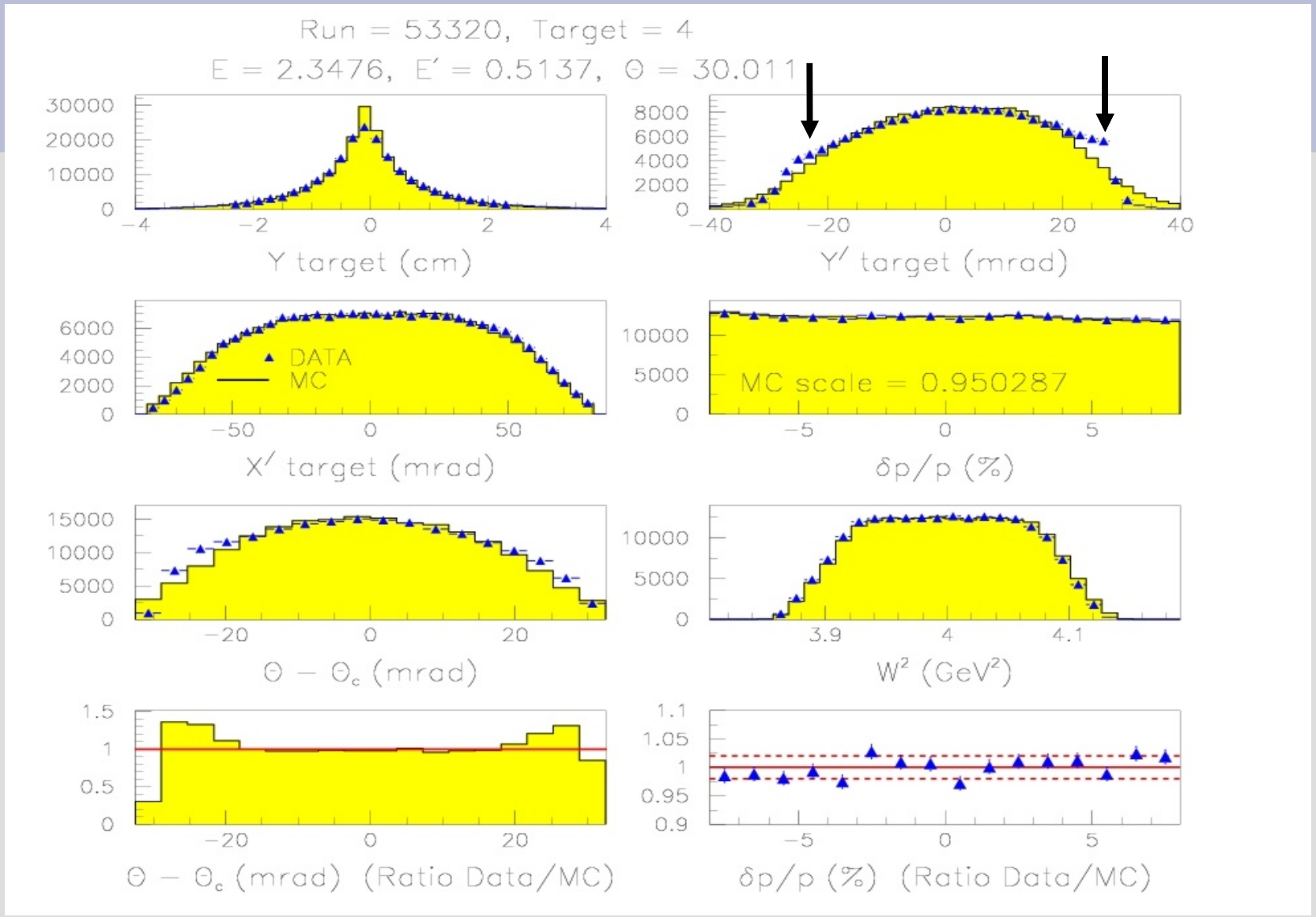
Focal plane is populated in area for which the fitted MEs are not well constrained.

Cut on artifact region in Y'_{tar}

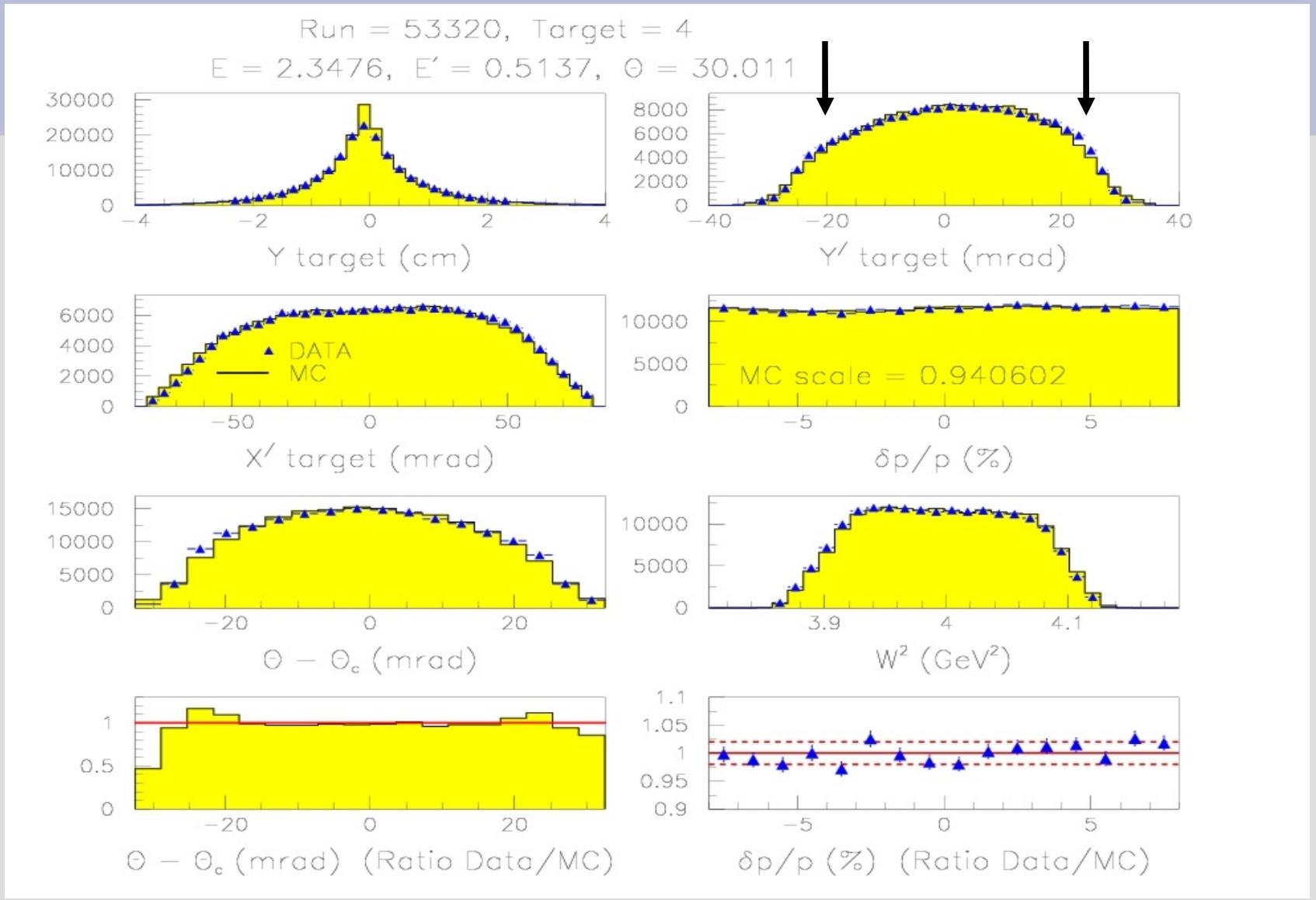


Place cuts on data falling in the intersection of these regions

Before Focal Plane Cuts



After Focal Plane Cuts



Conclusions

→ Fitted MEs at Edges in FP distributions are ***not*** well constrained and are subject to over fitting.

→ events at very edges can only populate This region by multiple scattering, which renders ME fitting unreliable!

- Need Reliable way to deal with data at edges.
- Cuts on FP distributions not accurate enough for precision cross sections (diff. in MC forward transport).

Preferable to improve data MEs over applying FP Cuts

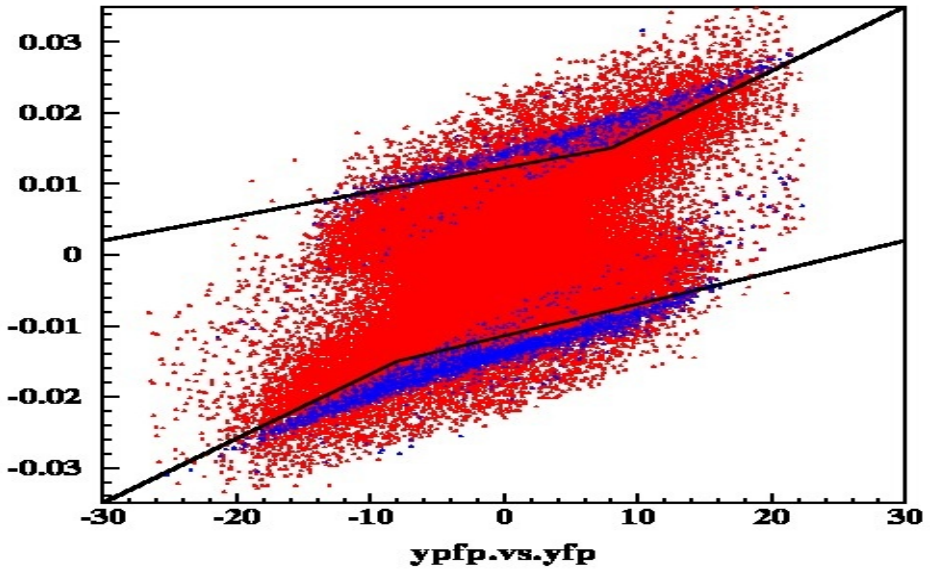
→ Can use fitted MEs in FP region which is well constrained (away from edges)

And

→ Use COSY in less well constrained region of FP

Applying Alternate MEs

→ After large combination of possible FP regions studied,
Decided on looser region to apply alternate (COSY) MEs.
(HU Ph.D. Student Ya. Li)



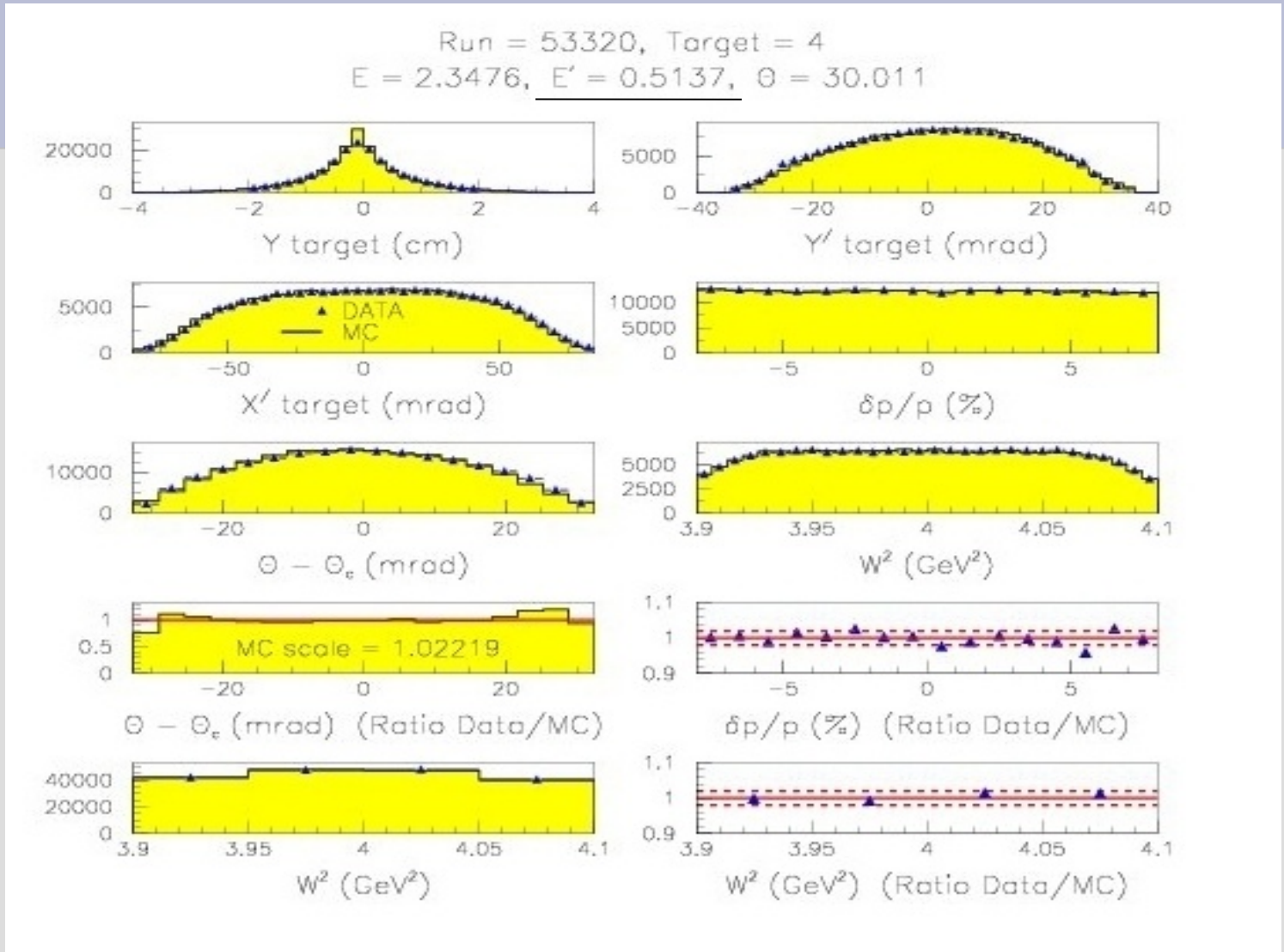
Events in central region

=> apply fitted MEs

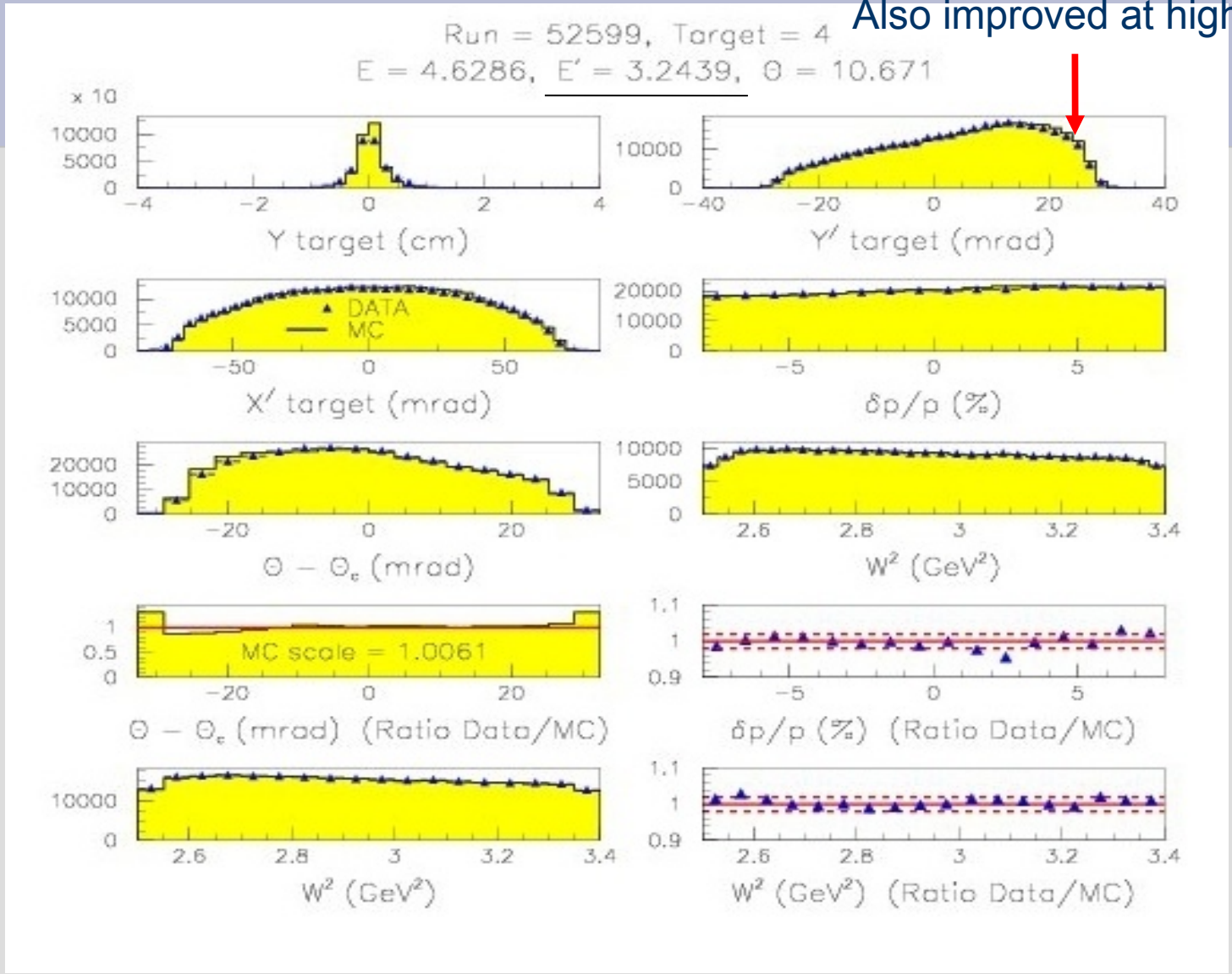
Events outside of lines

=> apply COSY MEs.

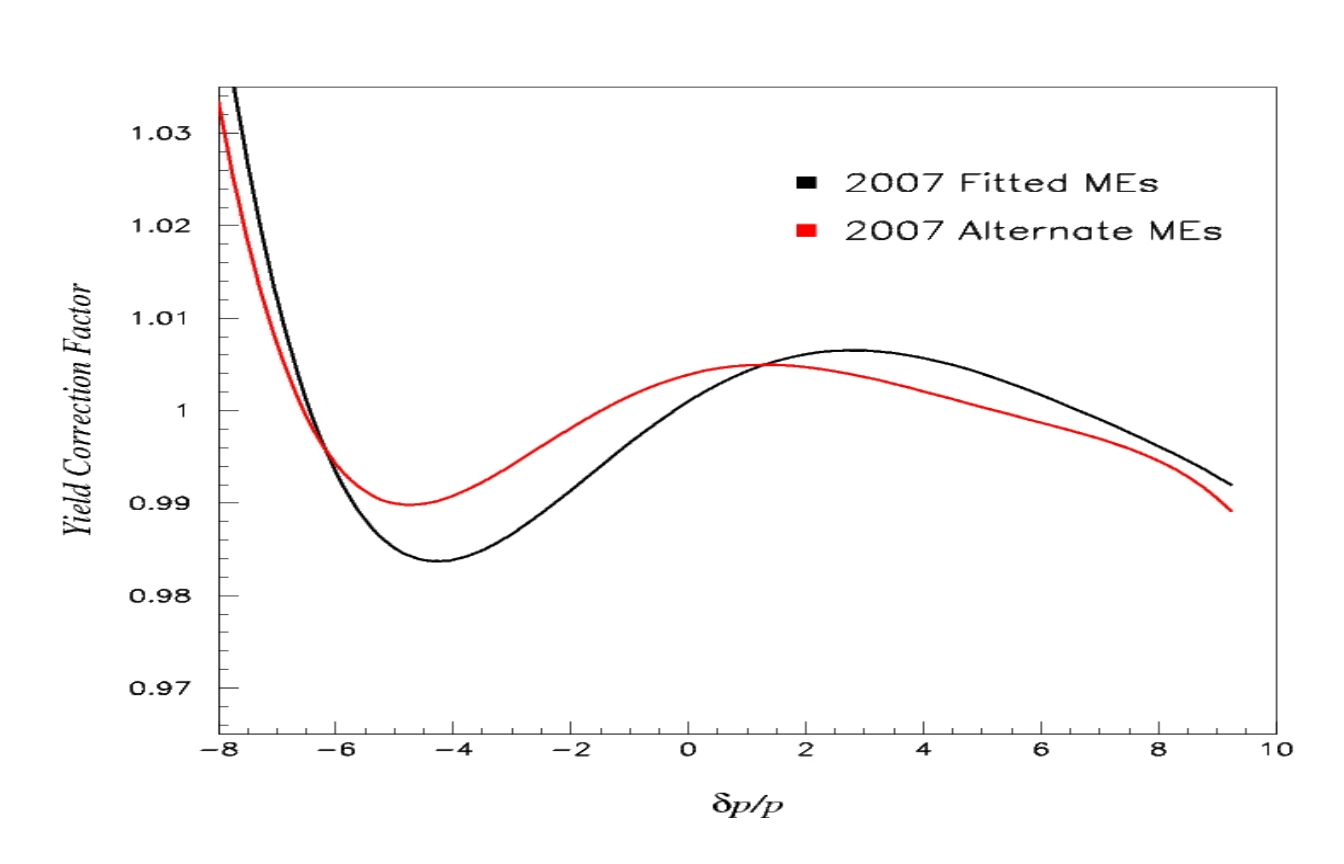
Alternate ME Results



Also improved at high E'



After alternate MEs



→ δ optics correction is reduced with alternate MEs.

→ Possible explanation is that over fitting is worse near edge of distributions at FP.

Conclusions

→ Would like to include Alternate Mes in standard Replay Engine.

→ Include flag in options file to turn off and on.

→ Possibly further optimize FP region of application